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LOCK FOR DOORS OR HATCHES OF VEHICLES

The invention pertains to a lock of the type indicated in the introductory clause of Claim 1. The lock is installed in the area of the door or hatch and has a rotary catch. A locking part is located on the door post, and when the door or hatch is closed by hand, the locking part travels into the rotary catch, thus pivoting it initially from a spring-loaded open position into a pre-latching position. The pre-latching position of the rotary catch is secured by a spring-loaded pawl. Then the motor of a door-closing assist mechanism is turned on by control means. This mechanism, operating by way of a gearbox and a cam, moves the rotary catch from the prelatching position to the main latching position. The main latching position of the rotary catch is also secured by the pawl, which engages with a main notch provided on the rotary catch.

Locks with motorized closing and opening mechanisms are known (WO 98/27301 A2), in which the gearbox has two takeoff routes, between which a gear element is installed with freedom

to pivot. This lock has proven to be reliable, but it is bulky and expensive.

A lock of the type indicated in the introductory clause of Claim 1 is known (DE 101 33 092 A1), which is less expensive that the previously described state of the art. In this known lock, the gearbox of the motor is engaged at all times and acts on two cams, one of which acts as a closing aid. This cam has a lobe, which, upon rotation of the motor, travels in one direction behind a shoulder of the rotary catch and, as previously mentioned, turns this from the pre-latching position into the main latching position under the action of the motor. As a result, the locking part engaged in the rotary catch is also carried along, and the door is brought into its final closed position on the vehicle.

In the case of a lock of a different type (DE 43 11 786 C2), in which the rotary catch has neither a preliminary notch nor a main notch, the spring-loaded pawl is mounted on the free end of an actuating rod, the other end of which is driven by a motorized crank drive. A permanently supported rocker acts on the free end of the actuating rod. As the door is being closed and the rotary catch is being carried along, the movable pawl, which is spring-loaded, drops behind a shoulder of the rotary

catch. When the motorized crank drive starts to turn, the pawl, which moves along with the actuating rod, carries the rotary catch along until it reaches the fully closed position. Then the motor stops, and the pawl remains engaged with the shoulder. At the same time, a lobe on the pawl travels under a fixed stop, which stops the movement of the free end of the actuating rod. The fixed stop is necessary so that, when the rotary catch is in the closed position, a hand or the motor can lift the pawl out of the rotary catch and hold it until the spring-loading force acting on the rotary catch can move the catch into its open position.

The invention has recognized that the disadvantage of the known lock is to be found in the direct connection between the cam and the rotary catch. For this reason, it is necessary to develop a new lock for each different type of vehicle to accommodate different sets of relationships. This not only requires the production and assembly of different lock elements, but also demands more complicated inventory control and increases the difficulty of repairing defective locks. Thus, for example, in the case of the previously mentioned known lock, it is not possible, when a change is made in the reduction ratio between the motor and the gearbox, simply to replace the gear

wheels, without at the same time providing the rotary catch with a different external profile, in which the shoulder for the eccentrically moving lobe occupies a different position. In the case of the known lock, it was therefore necessary to develop a separate lock for each vehicle to accommodate the specific circumstances and, if necessary, to keep such locks in inventory. This led to a large amount of manufacturing work and to complicated inventory management.

The invention is based on the task of developing a reliable, inexpensive lock of the type indicated in the introductory clause of Claim 1 which can be used in vehicles of different types, because at most only slight modifications are required. This is accomplished according to the invention by the measures cited in Claim 1, to which the following special meaning attaches.

In the invention, a pair of toggle-joint levers is installed between the cam and the rotary catch. This pair of levers carries a spring-loaded driver at the free end. Because it is spring-loaded, the driver is held against a stationary end surface in the housing, at least when the catch is in the pre-latching position. The free end of the pair of toggle-joint levers serving to support the driver is guided positively by

guide means in the lock housing. The other end of the pair of toggle-joint levers, i.e., the fixed end, is mounted rotatably on a stationary bearing. The cam has a control curve, against which the pair of toggle-joint levers is held under the force of a spring. The driver has a shoulder, to which is assigned an opposing shoulder on the rotary catch. The shoulder and the opposing shoulder are a certain distance apart in the open position, but when the motorized closing movement takes place, the pair of toggle-joint levers is shifted by the cam between different states of extension and/or inflection, during which the shoulder of the driver travels to the opposing shoulder of the rotary catch and moves the catch out of the pre-latching position into the main latching position.

In the invention, there is only an indirect connection between the cam and the rotary catch, namely, the connection established by the pair of toggle-joint levers and the driver articulated to them. So that the inventive lock can be applied to vehicles of different types, the cam, which has a certain defined control curve, can be easily replaced by a cam with a control curve of a different profile, the rest of the lock remaining unchanged. If necessary, however, it is possible, supplementally or alternatively, to remove the pair of toggle-

joint levers and/or the driver and to replace them with other, similar components with different proportions and/or profiles. It is possible, for example, to change the arm length of the pair of toggle-joint levers. Because of the ease with which such modifications can be implemented, the inventive lock is universally applicable. Thus the inventive lock can be produced in much larger numbers, which means that production costs can be reduced.

It is recommended that a guide rod be used as the guide means for the free end of the pair of toggle-joint levers. One end of this guide rod is hinged to the free end of the pair of toggle-joint levers, whereas the other end is mounted on a stationary bearing. This stationary bearing can also be the bearing of the rotary catch.

Additional measures and advantages of the invention can be derived from the subclaims, from the following description, and from the drawings. The drawings illustrate the invention in schematic fashion on the basis of an exemplary embodiment:

-- Figure 1a shows a schematic diagram of the opened lock housing, seen from above, where the lock parts are in the so-called "pre-latching position", which is present when the door has been brought manually into an intermediate position, which

does not yet represent the final closed position;

-- Figure 1b shows the same lock and the same position of the lock parts as shown in Figure 1a, except that some of the lock parts located at the top have been removed, namely, the pair of toggle-joint levers;

-- Figures 2a and 2b show views similar to those of Figures 1a and 1b of the same lock at the time when the motorized closing assist mechanism in the lock has been started;

-- Figures 3a and 3b show the same lock at the end of the completed closing-assist process, where the components are now located in an "overstroke" position; and

-- Figures 4a and 4b show the lock after the lock parts have arrived in a so-called "main latching position", which corresponds to the fully closed position of the door.

The lock has a lock housing 11 mounted on the door and a locking part 10 seated on the door post. In the lock housing 11, a rotary catch 20, which has a receptacle 23 for the locking part 10, is seated on a first, stationary bearing pin 12. When the door is open, the rotary catch is in its open position (not shown) in the lock housing 11, where the opening of the receptacle 23 is aligned with the slot 13 in the housing 11. The rotary catch 20 is spring-loaded in the direction toward its

open position, as illustrated by the arrow 25 in Figure 1a, and when in the open position it rests against end stops (not shown).

The door is first closed manually. As this happens, the locking part 10 travels into the receptacle 23, strikes the inner sidepiece, and thus rotates the catch 20 in the direction opposite its spring loading 25 until it reaches the "pre-latching position", characterized by the auxiliary line 20.1 in Figure 1b. In this pre-latching position 20.1, a pawl 30, which is spring-loaded in the direction of the force arrow 35, thus engages with a first or preliminary notch 21, provided on the rotary catch 20. The pawl 30 is supported on a second stationary bearing pin 32 in the lock housing 11, and in this case the locking point 31 of the pawl grips the preliminary notch 21 on the catch. As a result, the rotary catch 20 is initially secured in its pre-latching position 20.1; the door is in a preliminary closed position.

As can be seen in Figure 1a, a pair of levers 40 is installed in the lock housing 11. These levers are connected to each other by a toggle joint 43 and are therefore called the "pair of toggle-joint levers" in the following. One end 41 of the pair of toggle-joint levers 40 is supported on a third

stationary bearing pin 14 in the lock housing 11 and is therefore called the "fixed end" in the following. Although the other end 42 of the pair of toggle-joint levers 40 is able to move freely in the lock housing 11, it is guided positively by guide means. These guide means consist in the present case of a guide rod 15, one end 16 of which is hinged to the free end 42 of the pair of toggle-joint levers 40, whereas the other end 17 of the guide rod is held in a stationary bearing. To save space, the bearing 12 of the rotary catch 20 also serves as the bearing for the guide rod.

For reasons of clarity, the pair of toggle-joint levers 40 has been omitted from Figure 1b, as previously mentioned. Only the bearing point for the guide rod 15 at the free end 42 of the pair of levers remains visible. At this bearing point, the driver 33 is also hinged to the free end 42 of the pair of levers. As can be seen in Figure 1b, the driver 33 is spring-loaded in the direction of the force arrow 37. Because of this spring-loading 37, the driver is held against a stationary end surface 18 in the lock housing 11 when the catch is in the pre-latching position 20.1. This shoulder 34 is designed to cooperate with an opposing shoulder 24 on the rotary catch 20. In the open position 20.1 according to Figure 1b, a gap 36 is

present between the shoulder 34 and the opposing shoulder 24.

This spring-loading 37, which is also illustrated in Figure 1a, cooperates with the guide means 15 to ensure that the pair of toggle-joint levers 40 is held elastically against a control curve 51 of a motorized cam 50. The associated motor 52 is installed in the area of the lock housing 11. The motor acts on a schematically indicated gearbox 53, the output of which is a shaft 54. The cam 50 is mounted nonrotatably on the shaft.

When the door and the rotary catch 20 have arrived in the pre-latching position 20.1 of Figures 1a and 1b, the motor 52 is turned on. This can be done by means of sensors (not shown), which respond when the lock parts arrive in a position which characterizes this pre-latching position 20.1. Then the cam 50 is rotated by the motor 52 in the direction of the arrow 55 of Figure 1a, thus leaving its rest position indicated here by the number 50.1. This rest position 50.1 is present as long as the rotary catch is in the previously described open position and remains so until, as described above, the pre-latching position 20.1 is reached.

In a manner similar to that shown in Figures 1a and 1b, Figures 2a and 2b show a special "intermediate position", which is reached as the cam 50 undergoes further rotation 55,

illustrated here by the corresponding auxiliary line 50.2. This rotational position 50.2 has an effect on the position of the pair of toggle-joint levers 40; namely, the toggle joint 43 is pushed downward. Because of the positive guidance provided by the guide rod 15, however, as Figure 2b shows, the free end 42 of the lever pair is pivoted around the bearing pin 12 by the guide rod 15, as a result of which the shoulder 34 of the driver 33 comes in contact with the opposing shoulder 24 of the catch 20. To allow this movement, the previously mentioned end surface 18 in the lock housing is provided with a suitable profile.

As the cam 50 undergoes further rotation 55 and thus passes beyond the intermediate position of Figures 2a and 2b, the rotary catch 20 is therefore carried along by the driver 33; the closing movement of the door with respect to the locking part 10 on the door post is thus provided with a motorized assist. Figures 2a and 2b show the beginning of this closing assist process, where the rotary catch 20 is still in its pre-latching position 20.1 shown in Figures 1a and 1b. This situation changes as the cam 50 moves to its "maximum" position shown in Figures 3a and 3b, illustrated there by the auxiliary line 50.3.

In the rest position 50.1 of the cam 50 according to Figure

1a, the two levers of the toggle-joint lever pair 40 form a relatively small angle, indicated by the number 44.1. The toggle-joint lever pair 40 is in the "inflected" position here, as illustrated by the auxiliary lines 40.1 in Figure 1a. In the maximum position 50.3 of Figure 3a, the two levers of the pair 40 enclose a large angle, indicated by the number 44.2. The toggle-joint lever pair 40 is now in what amounts essentially to an "extended" position, indicated by the auxiliary lines 40.2 in Figure 3a.

In Figure 3a, the previously mentioned "closing assist" process has reached its maximum point. The free end 42 of the pair of toggle-joint levers 40 has moved onward to the maximum point under the guiding action of the guide rod 15. As a result, the driver 33 has been carried along as well, and its shoulder 34 has turned the rotary catch 20 even farther around its bearing pin 12. The rotary catch 20 has thus been brought into the rotational position indicated by the auxiliary line 20.2 in Figure 3b, which is called the "overstroke" position. The gripped locking part 10, as can be seen Figure 3b, has moved even deeper into the interior of the lock housing 11. In its overstroke position 20.2, the rotary catch 20 has turned so far that the locking point 31 of the pawl 30, under the action of

the spring-loading illustrated by the arrow 35, can snap into a second or main notch 22 on the rotary catch 20. The pawl 30 can be held in the position in which it is aligned with the main notch 22 by rotation stops illustrated schematically at 38. As Figure 3b shows, it is possible for a free gap 19 to remain between the locking point 33 and the main notch 22. This situation changes quickly, however, because the motor 52 is still running.

What then happens can be seen in Figures 4a and 4b. The cam 50 has again reached the position 50.1 of Figure 1a. At this point the motor 52 is stopped. This can be accomplished by the use of limit switches, sensors, etc. As a result, the pair of toggle-joint levers 40 again arrives in the inflected position 40.1, indicated by the small angle 44.1. Now the free end 42 of the toggle-joint lever pair 40 is located again in its starting position of Figure 1a, as a result of which the shoulder 34 of the driver 33, which is hinged at this free end, also returns to its original position, seen previously in Figure 1b, resting on the end surface 18 on the housing. The associated opposing shoulder 24 on the rotary catch 20 is now a good distance away from the shoulder 34, as can be seen by the distance marked 26 in Figure 4b.

This latter situation can be explained as follows. Because the rotary catch 20 is spring-loaded 25, when it is released it can rotate back the other way, but only over the distance of the free gap 19, previously described in Figure 3b. As Figure 4b shows, the main notch 22 of the rotary catch 20 then comes to rest against the locking point 31 of the pawl 30. As a result, during the remaining rotation 55 of the cam 50 in Figure 4a, the rotary catch 20 is held in the position illustrated by the auxiliary line 20.3 in Figure 4b, which can be referred to as the "main latching position". The locking part 10, which has been pulled into the lock housing 11, now assumes its final position there. The door is in its final, fully closed position, where the elastic seals between the door and the door opening in the vehicle are squeezed together. The inventive effect of the "closing assist" is complete.

The only thing needed to open the door is, as usual, to pull the locking point 31 of the pawl 30 away from the main notch 22 of Figure 4b, namely, in the direction opposite the spring-loading 35. This can be done in various ways, e.g., by the same motor 52, although this possibility is not shown. The reactivation of the motor 52 can be accomplished by remote control, where again an intermediate stop in a pre-latching

position 20.1 can be provided. The door can also be opened mechanically by the use of an inner or outer door handle, which acts by way of a chain of connecting elements (not shown) on the pawl 30. Insofar as the main latching position 20.3 is to be kept locked by means of, for example, a lock cylinder, provisions for unlocking it will be made in advance by means of a remote control device or by means of an electrical or mechanical key.

The inventive lock can be used equally effectively in vehicles of different types. Any modification which might be required can be accomplished quickly and easily. This can involve, for example, replacing the cam 50 shown in the figures with a different one with a control curve 51 better suited to the specific requirements. Supplementally or alternatively, it would also be possible to provide the pair of toggle-joint levers 40 with different shapes and sizes, and also to replace the driver 33 and/or the guide rod 15 with elements with different profiles.

The bearing end 17 of the guide rod could also be mounted on a point which moves concomitantly with the rotary catch 20 instead of on the stationary bearing point 12. In place of a guide rod 15, a curved cam surface permanently connected to the

housing could also be provided as a guide means, along which the free end 42 of the pair of toggle-joint levers 40 could slide or roll under positive guidance.

List of Reference Numbers

10	locking part
11	lock housing
12	bearing, first bearing pin in 11 for 20
13	slot in 11 for 10
14	bearing, third bearing pin in 11 for 43
15	guide means, guide rod
16	first end of guide rod 15 at 42
17	second end of guide rod 15 at 12
18	stationary end surface for 33 in 11
19	free gap between 31 and 22 (Figure 3b)
20	rotary catch
20.1	pre-latching position of 20 (Figures 1b, 2b)
20.2	overstroke latching position of 20 (Figure 3b)
20.3	main latching position of 20 (Figure 4b)
21	preliminary notch of 20
22	main notch of 20
23	receptacle in 20 for 10
24	opposing shoulder on 20 for 34
25	arrow of the spring-loading of 20
26	free distance between 34 and 24 (Figure 4b)

30	pawl
31	locking point of 30
32	bearing, second bearing pin on 11 for 30
33	driver
34	shoulder on 33 for 24
35	force arrow of the spring-loading of 30
36	distance between 24 and 34 (Figure 1b)
37	arrow of the spring-loading of 33
38	rotation stop for 30 (Figure 3b)
40	pair of toggle-joint levers
40.1	inflected position of 40 (Figures 1a, 4a)
40.2	extended position of 40 (Figure 3a)
41	fixed end of 40
42	free end of 40
43	toggle-joint area of 40
44.1	small angle at 40.1 (Figures 1a, 4a)
44.2	large angle at 40.2 (Figure 3a)
50	cam
50.1	rest position of 50 (Figures 1a, 4a)
50.2	intermediate position of 50 (Figure 2a)

50.3	maximum position of 50 (Figure 3a)
51	control curve on outside circumference of 50
52	motor for 50
53	gearbox between 52 and 50
54	output shaft of 53 for 50
55	arrow of rotational movement of 50